Attorney Docket No. 21195.00

IN THE APPLICATION

OF

O. GEMARE ADKISON

FOR A

TOOL WITH ENGAGING PORTION HAVING AXIAL OPENING AND RADIAL SLOT

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

TOOL WITH ENGAGING PORTION HAVING AXIAL OPENING AND RADIAL SLOT

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/404,763, filed August 21, 2002.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to a tool, and particularly to a wrench having at least one engaging portion, the wrench having an axial opening and a radial slot which may be used for many purposes including, but not limited to, tightening and loosening any standard (metric, standard, etc.) connector or fastening device such as a bathroom faucet nut, threaded nut, a threaded bolt, a spark plug, an engine head bolt, an automotive gas line, and an automotive brake line.

2. DESCRIPTION OF RELATED ART

Plumbers, mechanics, homeowners, carpenters, maintenance workers and tradespersons in many industries commonly use connectors to attach two members together. Often, such connectors are located in hard-to-reach spaces with limited working space near the connector. Also, such connectors may be

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

used in combination with a linear member, such as a water line in plumbing or a brake line in automotive mechanics. Particularly in performing maintenance, a tradesperson may encounter a connector, which was easy to reach during the initial installation of the connector, but has become hard-to-reach due to the subsequent installation of an intervening object.

For example, in plumbing, when a sink or lavatory is first installed, the water lines are attached with connectors before installation of the basin. Prior to installation of the basin, the connectors attaching the water line to the sink or lavatory is easy to reach; however, after installation of the basin, a small space is left between the basin and the cabinet or wall. Common plumbing tasks, such as repairing or replacing a faucet, require the removal and reattachment of these water lines. Because removal of the basin is time consuming and impractical, the only way to access the connector attaching the water line to the sink or lavatory is by approaching the connector from below through a tight space, however, due to the presence of the water line, the actual engagement with the connector can only happen from the side. The space to either side of the connector is often insufficient in size to allow the use of a conventional wrench. There is often fewer than a few inches of horizontal space to maneuver a tool for this task.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

Similarly, in automotive mechanics, a common task is removal and reattachment of a gas line or a brake line, which involves a linear member attached with a connector at one end of the line. As with plumbing, there is often limited space to allow use of a conventional wrench.

Various tools have been devised to access connectors in hard-to-reach spaces. However, many of these tools typically include engaging ends with multiple parts and a large cross-sectional area when measured in a direction perpendicular to the axis of the tool. The large cross-sectional area leads to at least two major problems: the tool is difficult to use in tight spaces and the engaging end of the tool is heavy thus fatiguing the user. Furthermore, many of these tools have multiple parts, making it expensive to manufacture and easy to damage or break. In addition, many of these tools do not permit a firm engagement with the connector in a direction parallel to the shaft of the tool, thereby allowing the connectors to slip off the tool, thus making use of the tool difficult and time consuming. Furthermore, the difficulty in using these tools often leads to the user becoming fatigued and prone to injure their knuckles or hands during operation of the tool.

For example, U.S. Patent No. 4,485,702, issued December 4, 1984 to Swan et al., discloses a basin wrench having a telescoping handle and a spring loaded movable jaw for clamping

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

a nut or pipe against a gripping face. The movable jaw and gripping face may be rotated about a shaft. The '702 patent also discloses a positive action basin wrench with additional features and an even bulkier and more complicated engaging end. While effective, both wrenches have engaging ends with multiple parts. These engaging ends have large cross-sectional areas when measured in a direction perpendicular to the axis of the tool that are difficult to use in tight spaces. Due to the complexity of the tools, they are expensive to manufacture and not very durable. Furthermore, the wrench disclosed in the '702 patent does not permit a firm engagement with the connector in a direction parallel to the shaft of the tool. The only surfaces engaging with the connector are the movable jaw and the gripping face or fixed jaw. There is no support for the connector in a direction parallel to the shaft of the tool. Consequently, the jaw may tend to slip off of the fastener.

U.S. Patent No. 4,928,559, issued May 29, 1990 to Stielow, discloses a ratchet wrench with a wrench body portion and a nut driver. The wrench body portion has a hole into which the nut driver rests. The nut driver has a hole and a sleeve insert. The hole has a hexagonal-shaped (six-sided) periphery in nut driver upper portion and a circular periphery in nut driver lower portion. The sleeve insert engages tightening nuts. The wrench body portion also includes a passageway or gap portion

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

and the nut driver has an opening or passageway; however, in order for the ratchet wrench to function, a detachable wedge portion must first be attached into the opening or passageway.

Although effective, the Stielow wrench suffers from the same limitation as the wrench disclosed in the '702 patent in that the wrench body portion and nut driver have a large cross-sectional area when measured in a direction perpendicular to the axis of the tool that is difficult to use in tight spaces. Furthermore, the wrench disclosed by Stielow is complicated, making it expensive to manufacture and easy to break. The shape of the hole only provides for a hexagonal-shaped (six-sided) periphery at one end and a circular periphery at the other, so that it is not possible to engage connectors with tapered connections to linear members, as with a flare wrench. Furthermore, the Stielow wrench is not functional without the additional step of attaching the detachable wedge portion after engagement of the tool with a connector.

U.S. Patent No. 5,251,519, issued October 12, 1993 to Lang, discloses a T-handle wrench kit with a handle and an operational block that secures a removable head. As with Swan, the Lang wrench has a large cross-sectional area at its engaging end when measured in a direction perpendicular to the axis of the tool, is expensive to manufacture, may break easily and there is no

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

support for the connector in a direction parallel to the shaft of the tool.

Other patents showing wrenches for engaging connectors include U.S. Patent 95,908, issued October 19, 1869 to W.H. Johnson (plumber=s tool; improvement in wash-pave key-handle); U.S. Patent No. 1,349,553, issued August 17, 1920 to J.R. Ayotte (hand tool); U.S. Patent No. 1,521,464, issued December 30, 1924 to R.E. Miller (wrench); U.S. Patent No. 1,677,473, issued July 17, 1928 to W.W. Gast (socket wrench and screw driver); U.S. Patent No. 1,885,593, issued November 1, 1932 to A.J. Downer (under pressure faucet and valve tool); U.S. Patent No. 2,491,623, issued December 20, 1949 to S.G. Sesak (basin wrench having rotatably adjustable inner-jaw and multiaxis-pivoted outer-jaw); U.S. Patent No. 2,263,508, issued November 18, 1941 to A. Lee (extension handle assembly); U.S. Patent No. 4,852,192, issued August 1, 1989 to Viegener (faucet assembly plumbing fixture); U.S. Patent No. 5,048,378, issued September 17, 1991 to Nikolas (tool and method for faucet nut installation); U.S. Patent No. 5,050,463, issued September 24, 1991 to Stielow (ratchet wrench); and U.S. Patent No. 5,519,929, issued May 28, 1996 to Bleckman (tool for removing faucet compression gasket).

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

invention as claimed. Thus, a tool solving the aforementioned problems is desired.

SUMMARY OF THE INVENTION

In order to solve the problems associated with the prior art tools discussed above, a tool with an engaging portion having an axial opening and a radial slot has been devised. The tool may be used for many purposes including but not limited to tightening and loosening any standard (metric, English, etc.) connector or fastening device such as a threaded nut, a threaded bolt, a spark plug, an engine head bolt, an automotive gas line, and an automotive brake line. The tool is particularly useful for engaging a connector, which is located in a hard-to-reach space with limited working space near the connector, particularly where a conventional wrench cannot be used. The tool of the present invention does not require the fabrication of multiple parts, is simple and inexpensive to manufacture, is durable, has a compact engaging end making it easy to use in tight spaces, permits a firm engagement with a connector in a direction parallel to the shaft of the tool, and may be formed with different types of engaging surfaces for engaging different types of connectors.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

The present invention is a tool with an engaging portion having an axial opening and a radial slot. The tool comprises a handle, a shaft comprising a shaft axis connected to the handle, and an engaging portion comprising an engaging portion axis, a first end and a second end. The first end is connected to the shaft. The engaging portion comprises an opening extending from the first end to the second end thereby defining an axially inner surface of the engaging portion and an axially outer surface of the engaging portion. The opening comprises a first portion at the first end with a first opening area and a second portion at the second end with a second opening area.

The first opening area may be adapted to engage with a standard ratchet. The first opening area may be smaller than the second opening area. The engaging portion further comprises a slot extending from the axially inner surface to the axially outer surface, and the second end of the axially inner surface comprises a plurality of engaging surfaces. The shaft and the engaging portion of the tool may be of one-piece construction.

The tool may optionally have an engaging portion with various geometries comprising various configurations of engaging surfaces. The engaging portion may be adapted to engage with any size connector using any standard. The tool may be provided such that the shaft axis is offset from the engaging portion axis. The tool may be provided such that the opening further

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

comprises an inner portion of the axially inner surface which is located between the first portion and the engaging surfaces, the inner portion comprises a third opening area, and the third opening area is smaller than the second opening area thus forming a seat. The intersection of any two engaging surfaces may be referred to as a point. The tool may be provided with the engaging portion comprising any number of points arranged in an arc about the engaging portion axis.

In another embodiment of the invention, a tool is provided which is substantially similar to the embodiment described above except that an engaging portion has a shorter depth when measured in the direction parallel to the engaging portion axis as compared to the embodiment described above. The second embodiment of the tool comprises a handle, a shaft comprising a shaft axis connected to the handle, and an engaging portion comprising an engaging portion axis, a first end and a second end. The first end is connected to the shaft. The engaging portion comprises an opening extending from the first end to the second end thereby defining an axially inner surface of the engaging portion and an axially outer surface of the engaging portion. The engaging portion comprises a slot extending from the axially inner surface to the axially outer surface. The axially inner surface comprises a plurality of engaging surfaces.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

The tool may optionally have an engaging portion with various geometries comprising various configurations of engaging surfaces. The shaft and the engaging portion of the tool may be of one-piece construction. The axially inner surface of the tool may comprise any number of equally sized engaging surfaces. The shaft axis of the tool may be offset from the engaging portion axis. The engaging portion and the engaging surfaces of the tool may be adapted to allow engagement with a standard sized connector. The engaging portion of the tool may comprise any number of points arranged in an arc about the engaging portion axis. The slot of the tool may be adapted to accommodate a linear member attached to a connector. The slot of the tool may be adapted to accommodate a standard sized water line for a sink or a lavatory by means of a connector.

In another embodiment of the invention, a tool is provided which is substantially similar to the embodiments described above except that no handle is provided, and there is a second engaging portion. Substantially cylindrical in shape with a slot extending its length, the second engaging portion has a plurality of tapering engaging surfaces, the axial opening getting smaller away from the end. Furthermore, the first end has notches disposed thereon for cooperatively engaging wing nut connectors, which are common on bathroom fixtures.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

Accordingly, it is a principal object of the invention to provide a tool for tightening and loosening standard connectors or fastening devices.

It is a further object of the invention to provide a tool for use in plumbing, automotive, locomotive, aerospace, shipbuilding, and farming.

It is another object of the invention to provide a tool for tightening and loosening a spark plug, an engine head bolt, an automotive gas line, or an automotive brake line.

Still another object of the invention is to provide a tool for engaging a connector, which is located in a hard-to-reach space with limited working space near the connector, particularly where a conventional wrench cannot be used.

It is a further object of the invention to provide a tool with a small cross-sectional area when measured in a direction perpendicular to the axis of the tool.

It is another object of the invention to provide a lightweight tool easily manipulated in close quarters.

Still another object of the invention is to provide a tool, which is inexpensive to manufacture.

It is a further object of the invention to provide a tool with one-piece construction, which is durable and difficult to damage or break.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

It is another object of the invention to provide a tool, which permits a firm engagement with a connector in a direction parallel to the shaft of the tool.

Still another object of the invention is to provide a tool that prevents fatigue or injury of the user's knuckles or hands during operation of the tool.

It is a further object of the invention to provide a tool adapted to attach or remove a linear member attached to a connector.

It is another object of the invention to provide a tool adapted to accommodate a standard sized water line for a sink or a lavatory by means of a connector having a tapered head.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. **1** is an environmental, perspective view of a tool with an engaging portion having an axial opening and a radial slot

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

according to the present invention engaged with a linear member and a connector.

Fig. **2** is an environmental, perspective view of a tool with an engaging portion having an axial opening and a radial slot with further emphasis on the engaging portion.

Fig. **3** is an environmental, perspective view with emphasis on the engaging portion and the optional engagement of a ratchet with the first end of the engaging portion.

Fig. **4** is an end view of a second end of the engaging portion with 8 engaging surfaces engaging a connector and a slot, which is about 33% open.

Fig. **5** is an end view of an alternate version of the second end of the engaging portion with 5 engaging surfaces engaging a connector and a slot that is about 17% open.

Fig. **6** is an end view of the second end of the engaging portion shown in Fig. **4** without the connector showing an inner portion with a third area and a seat formed in the engaging portion.

Fig. **7** is an end view of the alternate version of the second end of the engaging portion shown in Fig. **5** without the connector showing an inner portion with a third area and a seat formed in the engaging portion.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

Fig. **8** is an environmental, perspective view of another embodiment of the present invention showing a tool with an engaging portion having an axial opening and a radial slot.

Fig. **9** is an environmental, perspective view of another embodiment of the present invention showing a cylindrical wrench having two axial openings and engaging surfaces disposed on either end, and a radial slot extending from the first end to the other end, the wrench being used to remove a water line connector.

Fig. **10** is a detailed perspective view of the present invention according to Fig. **9**.

Fig. **11** is an end view of a first end of the tool according to Fig. **9**, detailing the axial opening forming a multi-faceted engaging surface, having a radial slot and notched engaging surfaces.

Fig. **12** is an end view of the second end of the tool according to Fig. **9**, detailing the axial opening forming a tapered engaging surface with a radial slot.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a tool with an engaging portion having at least one axial opening and a radial slot. The tool may be used for many purposes including but not limited to tightening and loosening any standard (metric, English, etc.) connector or fastening device such as a threaded nut, a threaded bolt, a spark plug, an engine head bolt, an automotive gas line, and an automotive brake line. The tool can be used in various industries including but not limited to plumbing, automotive, locomotive, aerospace, shipbuilding, and farming. The tool is particularly useful for engaging a connector, which is located in a hard-to-reach space with limited working space near the connector, particularly where a conventional wrench cannot be used.

A first embodiment of the invention is generally described as **10** in Figs. **1-7**, and, as shown in Fig. **1**, may be used to attach a roughly linear member **100**, such as a water line **110** used in plumbing, to a sink or lavatory by means of connector **120**. Connectors may be of any type. Typically, such connectors **120** are commonly 6-sided nuts or bolts. The present invention may be adapted for use with other types of connectors in accordance with the teachings of the present invention.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

As shown in Figs. **1** and **2**, the tool **10** comprises a handle **20**. In the figures, the handle **20** is shown with a screwdriver type handle; however, the handle **20** may be any type for use by a human user or in combination with another tool or machine, such as a ratchet or power tool. The handle **20** may be composed of any suitable material such as hard plastic. If the tool **10** is to be adapted for human use, the handle **20** may be a common sized handle with a common grip.

The tool **10** further comprises a shaft **30** comprising a shaft axis **32** connected to the handle **20**. Although the shaft **30** is shown with a circular cross-section, the shaft **30** may be any geometric shape. The shaft **30** may be composed of any suitable material such as steel. For the specific purpose of attaching a water line **110** to a sink by means of a connector **120**, the shaft **30** may be between 4" and 12" in length when measured along the shaft axis **32**. Smaller or larger dimensions of the shaft **30** may be provided for smaller or larger connectors.

The tool **10** further comprises an engaging portion **40** comprising an engaging portion axis **41**, a first end **42** and a second end **43**. The first end **42** is connected to the shaft **30**. The engaging portion **40** is shown with a substantially cylindrical shape; however, any suitable shape may be used. For the specific purpose of attaching a water line **110** to a sink by means of a connector **120**, the engaging portion **40** may be between

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

2" and 3-1/4" in length when measured along the engaging portion axis **41**, and the outside diameter may be between 1-1/8" (for engaging with a 3/4" connector) and 1-5/16" (for engaging with a 15/16" connector). Smaller or larger dimensions of the engaging portion **40** may be provided for smaller or larger connectors, respectively.

The overall length of the embodiment of the tool **10** for the specific purpose of attaching a water line **110** to a sink by means of a connector **120** may be between 9" and 18". Again, smaller or larger dimensions of the tool **10** may be provided for smaller or larger connectors or different working conditions.

The engaging portion **40** comprises an opening **44** extending from the first end **42** to the second end **43** thereby defining an axially inner surface **45** of the engaging portion **40** and an axially outer surface **46** of the engaging portion **40**. The opening **44** comprises a first portion **47** at the first end **42** with a first opening area **A1** (see Figs. **6** and **7**) and a second portion **48** at the second end **43** with a second opening area **A2** (see Figs. **4-7**). As shown in Figs. **6** and **7**, opening **44** substantially forms the first opening area **A1** and the remainder is shown with a dotted line as an extension of the opening **44**. The first opening area **A1** is shown as square in shape, but may be of any suitable geometry. As shown in Fig. **3**, the first opening area **A1** may be adapted to engage with a standard ratchet **130**. As

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

shown in Fig. **4**, opening **44** substantially forms the second opening area **A2** and the remainder is shown with a dotted line as an extension of the opening **44**. The second opening area **A2** is shown as a 12-sided shape in Figs. **4** and **6** and as a 6-sided shape in Figs. **5** and **7**, but the second opening area may be of any suitable geometry.

The first opening area **A1** may be smaller than the second opening area **A2**. In the specific case of attaching a water line **110** by means of a connector **120**, the water line **110** often includes a tapered portion **112** (see Fig. **1**). Accordingly, by providing that the first opening area **A1** is smaller than the second opening area **A2**, the engaging portion **40** of the present invention may be adapted to accommodate the tapered portion **112** of a water line **110**.

As seen best in Fig. **2**, the engaging portion **40** further comprises a slot **50** extending from the axially inner surface **45** to the axially outer surface **46**, and the second end **43** of the axially inner surface **45** comprises a plurality of engaging surfaces **51**. The second end **43** of the axially inner surface **45** may comprise any number of equally sized engaging surfaces **51**. The particular characteristics of the slot **50** are discussed in greater detail below.

The shaft **30** and the engaging portion **40** of the tool **10** may be of one-piece construction. A one-piece construction may be

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

accomplished by any suitable method including molding or die-casting.

As seen best in Figs. **4** through **7**, the tool **10** may optionally have an engaging portion **40** with various geometries comprising various configurations of engaging surfaces **51a**, **51b**.

In Fig. **4**, the tool **10** is provided such that the engaging portion **40** has 8 equally sized linear engaging surfaces **51a** and the slot **50** comprises about 33% of the circumference of the engaging portion **40**. The engaging portion **40** shown in Fig. **4** allows the tool **10** to slide over a connector **120** and an attached linear member **100** in a direction either parallel or perpendicular to the engaging portion axis **41**. Although the tool **10** in Fig. **4** is shown with 8 engaging surfaces **51a**, the tool **10** may be provided such that the engaging portion **40** has 4 equally sized linear engaging surfaces (not shown) and the slot **50** comprises about 33% of the circumference of the engaging portion **40**. The tool **10** may also be provided such that the engaging portion **40** has 10 equally sized linear engaging surfaces (not shown) and the slot **50** comprises about 17% of the circumference of the engaging portion **40**.

In Fig. **5**, the tool **10** is provided such that the engaging portion **40** has 5 equally sized linear engaging surfaces **51d** and the slot **50** comprises about 17% of the circumference of the engaging portion **40**. The engaging portion **40** shown in Fig. **5**

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

allows the tool **10** to slide over a connector **120** in a direction parallel to the engaging portion axis **41** and an attached linear member **100** in a direction either parallel or perpendicular to the engaging portion axis **41**.

The engaging portion **40** is shown based on 6 point and 12 point configurations; however, other configurations may be used with a slot **50** comprising about 17% to 33% of the circumference of the engaging portion **40**. For instance, 4 point or 8 point configurations may be provided for engaging 4 point or 8 point connectors.

Optionally, the engaging surfaces **51a** and **51b** may also take the form of equally sized roughly V-shaped or U-shaped grooves or any other suitable shape (not shown). Such grooves allow for a better grip on the points of the connector **120**. Further, optionally, two of the engaging surfaces adjacent to the slot **50** may have a shorter length than the other equally sized engaging surfaces so as to allow the fabricator of the tool **10** to form the slot **50** to any desirable size and accommodate any size linear member **100**.

Generally speaking, the slot **50** should be of a size that permits a linear member **100**, such as a water line **110**, to pass through the slot **50**. In the case of a tool **10** for attaching a water line **110** to a lavatory or sink by means of a connector **120**, the slot **50** may be about 9/16" when measured in a direction

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

perpendicular to the engaging portion axis **41**. As noted above, the slot **50** may comprise between about 17% and about 33% of the circumference of the engaging portion **40**. For other uses, the slot **50** may be adapted to a different size, as needed.

The engaging portion **40** may be adapted to engage with any size connector using any standard, for example metric or English standard. In the specific case of a tool **10** for attaching a water line **110** to a sink by means of a connector **120**, the engaging surfaces **51** should be adapted to fit a 3/4" connector. In the specific case of a tool **10** for attaching a water line **110** to a lavatory by means of a connector **120**, the engaging surfaces **51** should be adapted to fit a 15/16" connector.

As seen best in Fig. **2**, the tool **10** may be provided such that the shaft axis **32** is offset from the engaging portion axis **41**. When attaching a linear member **100** by means of a connector **120**, it is desirable to have the shaft axis **32** offset from the engaging portion axis **41** so as to permit the linear member **100** to extend through the engaging portion **41** without interfering with the operation of the tool **10** in tightening and loosening the connector **120**. The offset also permits the user of the tool to see the connector **120** prior to engaging the tool **10** with the connector **120**.

As noted in detail above, the tool **10** may be provided such that the engaging portion **40** and engaging surfaces **51** are

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

adapted to allow engagement with a standard sized connector **120**. As noted in detail above, the tool **10** may be provided such that the first portion **47** of the opening **44** is adapted to fit a standard ratchet **130**.

As seen best in Figs. **2**, **6** and **7**, the tool **10** may be provided such that the opening **44** further comprises an inner portion **49** of the axially inner surface **45** which is located between the first portion **47** and the engaging surfaces **51**, the inner portion **49** comprises a third opening area **A3**, and the third opening area **A3** is smaller than the second opening area **A2**. It is desirable to provide that the third opening area **A3** be smaller than the second opening area **A2** to provide a seat **52** for the connector in the second end **43** of the engaging portion **40** while still providing enough space for the linear member **100** to pass through the engaging portion **40** in a direction parallel to the engaging portion axis **41**. The seat **52** prevents the connector **120** from moving in a direction parallel to the engaging portion axis **41** during operation of the tool **10**.

The intersection of any two engaging surfaces **51** may be referred to as a point **53**. As seen in Figs. **4** and **6**, the tool **10** may be provided with the engaging portion **40** comprising any number of points **53** arranged in an arc about the engaging portion axis **41**, in this case 7 points **53**. As seen in Figs. **5** and **7**, the tool **10** may be provided with the engaging portion **40**

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

comprising any number of points **53** arranged in an arc about the engaging portion axis **41**, in this case 4 points **53**.

In another embodiment of the invention, as seen in Fig. **8**, a tool **200** is provided which is substantially similar to the embodiment described above except that an engaging portion **240** has a shorter depth when measured in the direction parallel to the engaging portion axis **241** as compared to the embodiment described above. Similar structural elements are referred to with similar reference numerals except starting with **200**.

The tool **200** comprises a handle **220**, a shaft **230** comprising a shaft axis **232** connected to the handle **220**, and an engaging portion **240** comprising an engaging portion axis **241**, a first end **242** and a second end **243**. The first end **242** is connected to the shaft **230**, and the engaging portion **240** may have a substantially cylindrical shape. The engaging portion **240** comprises an opening **244** extending from the first end **242** to the second end **243** thereby defining an axially inner surface **245** of the engaging portion **240** and an axially outer surface **246** of the engaging portion **240**. The engaging portion **240** comprises a slot **250** extending from the axially inner surface **245** to the axially outer surface **246**. The axially inner surface **245** comprises a plurality of engaging surfaces **51**.

The tool **200** may optionally have an engaging portion **240** with various geometries comprising various configurations of

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

engaging surfaces **51a**, **51b** as seen best in Figs. **4** and **5**. The shaft **230** and the engaging portion **240** of the tool **200** may be of one-piece construction. The axially inner surface of the tool **200** may comprise any number of equally sized engaging surfaces **51**. The shaft axis **232** of the tool **200** may be offset from the engaging portion axis **241**. The engaging portion **240** and the engaging surfaces **51** of the tool **200** may be adapted to allow engagement with a standard sized connector **120**. The engaging portion **240** of the tool **200** may comprise any number of points arranged in an arc about the engaging portion axis **241**. The slot **250** of the tool **200** may be adapted to accommodate a linear member **100** attached to a connector **120**. The slot **250** of the tool **200** may be adapted to accommodate a standard sized water line **110** for a sink or a lavatory (not shown) by means of a connector **120**.

Although the tool **10**, **200** is illustrated with either 8 equally sized engaging surfaces **51a** (Figs. **4** and **6**) or with 5 equally sized engaging surfaces **51b** (Figs. **5** and **7**) and in engagement with a 6-sided connector **120**, it should be noted that the tool **10**, **200** may be adapted with any number of engaging surfaces **51** and adapted to engage with any shape of connector **120**.

In another embodiment of the present invention, the tool **10**, **200** may be provided with an open-end wrench in lieu of the

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

handle **20**, **220**, and the engaging portion **40**, **240** may be provided such that the engaging portion axis **41**, **241** is either parallel or perpendicular to the shaft axis **32**, **232**. This embodiment of the invention has been found to be particularly useful in plumbing applications.

Those skilled in the art will appreciate that in certain situations, a smaller tool manipulated by hand would have access to areas where a longer tool with an extended handle would be unwieldy or impossible to position correctly. Figs. **9-12** disclose an alternate embodiment of the present invention, described generally as **300** in the drawings, which is substantially similar to the embodiments described above except that the tool **300** is not encumbered by a handle and is comprised of a hollow cylindrical wrench of unitary construction formed from rigid plastic material, aluminum, or any rigid material capable of cooperatively engaging a multi-faceted connector **120**. Similar structural elements are referred to with similar reference numerals, except that the numerals start with **300**.

As shown in Fig. **9**, one use of the tool **300** is to attach a roughly linear waterline **304** to a sink (not shown) by means of a wing nut connector **302**. As best shown in Fig. **10**, the tool **300** is a generally hollow cylinder, having a first end **306**, a second end **310**, and a slot **312** extending from the first end **306** to the second end **310**, the slot being adapted to receive a linear

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

waterline **304**, thereby enabling either end **306, 310** to cooperatively engage a connector. The overall length of the embodiment of the tool **300** shown in Figs. **9-12** for the specific purpose of attaching a water line **304** to a sink by means of a connector **302** may be 5" to 8".

The inner surface of each end **306, 310** is formed by a plurality of engaging surfaces **318, 316** adapted to receive a multi-faceted connector, extending approximately 3/4" inward from the end of the tool **300.** Smooth outer surfaces **324, 326** are formed on each end **306, 310** of the tool **300**; however, any suitable shape may be used. The center portion of the tool **300**, approximately 5" in length, has a plurality of flat engaging surfaces **320** extending along the outer surface of the tool **300**, the surfaces **320** providing a gripping surface for the user's hand or capable of cooperatively engaging an open end wrench (not shown) should more torque be necessary to remove stubborn connectors. Although the present embodiment of the tool **300** has five engaging surfaces **320** spaced around the outer surface of the central portion **308** of the tool **300**, the actual number of surfaces may be more or less than the five shown, the primary purpose of the flat surfaces **320** being to provide a non-uniform gripping surface.

As previously described in the previous embodiments **10, 200** of the tool, Figs. **9** and **10** disclose a slot **312** disposed in the

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

wall of the tool extending from the first end **306** to the second end **310** which should be of a size that permits a water line **304** to pass through the slot **312**.

The engaging surfaces **318** on the inside surface of the first end **306** of the tool **300** may be adapted, as in the previous embodiments **10**, **200** of the invention, to engage with any size connector using any standard. As shown in Fig. **11** of the present embodiment, which is adapted for the specific purpose of attaching a water line to a sink by means of a hexagonal connector **120**, the engaging surfaces **318** should be adapted to fit a 3/4" connector.

For the specific purpose of attaching a water line **304** to a sink by means of wing nut **302**, Figs. **10** and **11** best illustrate three "U" shaped notches **330** cut in the cylindrical wall of the first end **306** of the tool **300**, approximately 1/4" in length. The three notches **330** are spaced at 90-degree intervals around the circumference of the end **306** of the tool **300**, two notches **330a**, **330c** diametrically opposite each other and notch **330b** disposed directly opposite the midpoint of slot **312**. Referring back to Fig. **9**, in practice, notches **330a**, **330c** cooperatively engage wing nut **302**, at which point the application of torque around rotational axis **R** would operate to remove or fasten nut **302**.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000

In the specific case of a tool **300** for attaching a water line to a lavatory or other facility by means of a connector (not shown) having a plurality of tapered sides, the second end **310** of tool **300** has five engaging surfaces **316**, tapering from 15/16" at the end of the tool to 7/8", approximately 3/4" from the second end **310** of the tool **300**.

The outside diameter of the tool **300** may be approximately 1-5/16"; smaller or larger dimensions of the tool **300** may be provided for smaller or larger connectors, respectively.

It is to be understood that the present invention is not limited to the sole embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000